

# IPS031G/IPS032G

## SINGLE/DUAL FULLY PROTECTED POWER MOSFET SWITCH

### Features

- Over temperature shutdown
- Over current shutdown
- Active clamp
- Low current & logic level input
- E.S.D protection

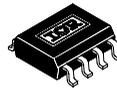
### Description

The IPS031G/IPS032G are fully protected single/dual low side SMART POWER MOSFETs that feature over-current, over-temperature, ESD protection and drain to source active clamp. These device combine a HEXFET POWER MOSFET and a gate driver. They offer full protection and high reliability required in harsh environments. The driver allows short switching times and provides efficient protection by turning off the power MOSFET when the temperature exceeds 165°C or when the drain current reaches 12A. These device restart once the input is cycled. The avalanche capability is significantly enhanced by the active clamp and covers most inductive load demagnetizations.

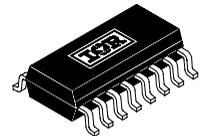
### Product Summary

$R_{ds(on)}$	70mW (max)
$V_{clamp}$	50V
$I_{shutdown}$	12A
$T_{shutdown}$	165°C
$T_{on}/T_{off}$	1.5ms

### Available Package

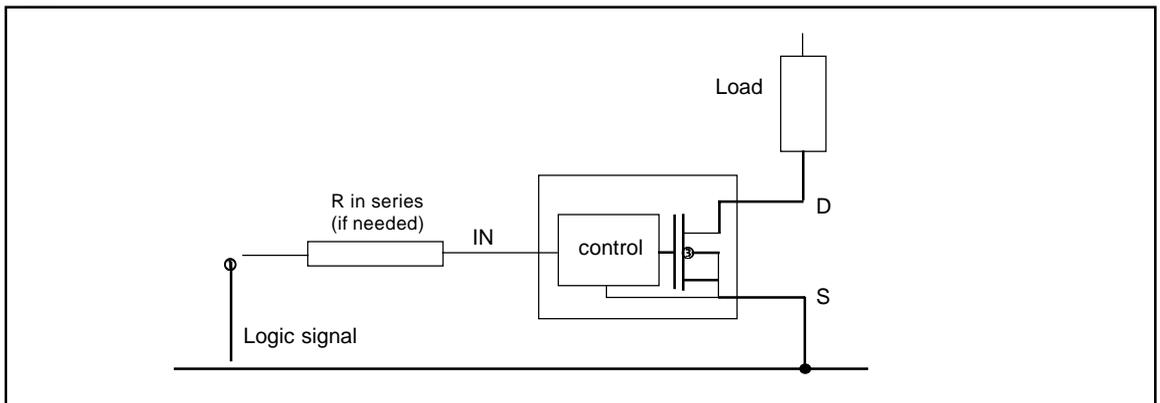


8 Lead SOIC  
IPS031G



16 Lead SOIC  
IPS032G  
(Dual)

### Typical Connection



## Absolute Maximum Ratings

Absolute maximum ratings indicates sustained limits beyond which damage to the device may occur. All voltage parameters are referenced to SOURCE lead. ( $T_{Ambient} = 25^{\circ}C$  unless otherwise specified). PCB mounting uses the standard footprint with 70mm copper thickness. All Sources leads of each mosfet must be connected together to get full current capability

Symbol	Parameter	Min.	Max.	Units	Test Conditions
$V_{ds}$	Maximum drain to source voltage	—	47	V	
$V_{in}$	Maximum input voltage	-0.3	7		
$I_{in, max}$	Maximum IN current	-10	+10	mA	
$I_{sd cont.}$	Diode max. continuous current <sup>(1)</sup> ( $r_{th}=125^{\circ}C/W$ ) IPS031G	—	1.4	A	
	( $\hat{a}$ $I_{sd}$ mosfets, $r_{th}=85^{\circ}C/W$ ) IPS032G	—	2		
$I_{sd pulsed}$	Diode max. pulsed current <sup>(1)</sup> (for ea. mosfet)	—	15		
$P_d$	Maximum power dissipation <sup>(1)</sup> ( $r_{th}=125^{\circ}C/W$ ) IPS031G	—	1	W	
	( $\hat{a}$ $P_d$ mosfets, $r_{th}=85^{\circ}C/W$ ) IPS032G	—	1.5		
ESD1	Electrostatic discharge voltage (Human Body)	—	tbd	V	C=100pF, R=1500 $\omega$ ,
ESD2	Electrostatic discharge voltage (Machine Model)	—	tbd		C=200pF, R=0 $\omega$ ,
$T_j$ max.	Max. storage & operating junction temp.	-40	+150	$^{\circ}C$	

## Thermal Chacteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$R_{th1}$	Thermal resistance with standard footprint	—	100	125	$^{\circ}C/W$	SOIC-8
$R_{th2}$	Thermal resistance with 1" square footprint	—	—	80		
$R_{th1}$ (2 mos on)	Thermal resistance with standard footprint (2 mosfets on)	—	85	—		SOIC-16
$R_{th2}$ (1 mos on)	Thermal resistance with standard footprint (1 mosfet on)	—	100	—		
$R_{th3}$ (2 mos on)	Thermal resistance with 1" square footprint (2 mosfets on)	—	60	—		

(1) Limited by junction temperature (pulsed current limited also by internal wiring)

## Recommended Operating Conditions

These values are given for a quick design. For operation outside these conditions, please consult the application notes.

Symbol	Parameter	Min.	Max.	Units
V <sub>ds</sub> (max)	Continuous Drain to Source voltage	—	35	V
V <sub>IH</sub>	High level input voltage	4	6	
V <sub>IL</sub>	Low level input voltage	0	0.5	
I <sub>ds</sub> T <sub>amb</sub> =85°C	Continuous drain current (T <sub>Ambient</sub> = 85°C, I <sub>N</sub> = 5V, r <sub>th</sub> = 100°C/W, T <sub>J</sub> = 125°C) IPS031G (T <sub>Ambient</sub> = 85°C, I <sub>N</sub> = 5V, r <sub>th</sub> = 85°C/W, T <sub>J</sub> = 125°C) IPS032G	—	2.2 1.65	A
R <sub>in</sub>	Recommended resistor in series with IN pin	0.2	5	k <sub>Ω</sub>
T <sub>r-in</sub> (max)	Max recommended rise time for IN signal (see fig. 2)	—	1	ms
F <sub>r-Isc</sub> <sup>(2)</sup>	Max. frequency in short circuit condition (V <sub>cc</sub> = 14V)	0	1	kHz

## Static Electrical Characteristics

(T<sub>J</sub> = 25°C unless otherwise specified.)

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
R <sub>ds(on)</sub> @T <sub>J</sub> =25°C	ON state resistance T <sub>J</sub> = 25°C	—	52	70	m <sub>Ω</sub>	V <sub>in</sub> = 5V, I <sub>ds</sub> = 1A
R <sub>ds(on)</sub> @T <sub>J</sub> =150°C	ON state resistance T <sub>J</sub> = 150°C	—	82	110		
I <sub>dss</sub> (max) @T <sub>J</sub> =25°C	Continuous I <sub>d</sub> current @ T <sub>C</sub> =25°C	4	5.5	—	A	Self limited @ T <sub>J</sub> =165°C
I <sub>dss</sub> @T <sub>J</sub> =25°C	Drain to source leakage current	0	0.5	25	mA	V <sub>CC</sub> = 14V, T <sub>J</sub> = 25°C, V <sub>in</sub> = 0V
V <sub>clamp 1</sub>	Drain to source clamp voltage 1	47	52	—	V	I <sub>d</sub> = 20mA (see Fig.3 & 4)
V <sub>clamp 2</sub>	Drain to source clamp voltage 2	—	54	60		I <sub>d</sub> =I <sub>shutdown</sub> (see Fig.3 & 4)
V <sub>sd</sub>	Body diode forward voltage	—	0.85	1		I <sub>d</sub> = 5A, V <sub>in</sub> = 0V
V <sub>in clamp</sub>	IN to source clamp voltage	7	8.1	9.5		I <sub>in</sub> = 1 mA
V <sub>th</sub>	IN threshold voltage	1	1.6	2		I <sub>d</sub> = 50mA
I <sub>in, on</sub>	Input supply current (normal operation)	25	80	200	mA	V <sub>in</sub> = 5V
I <sub>in, off</sub>	Input supply current (protection mode)	50	130	250		V <sub>in</sub> = 5V over-current triggered

## Switching Electrical Characteristics

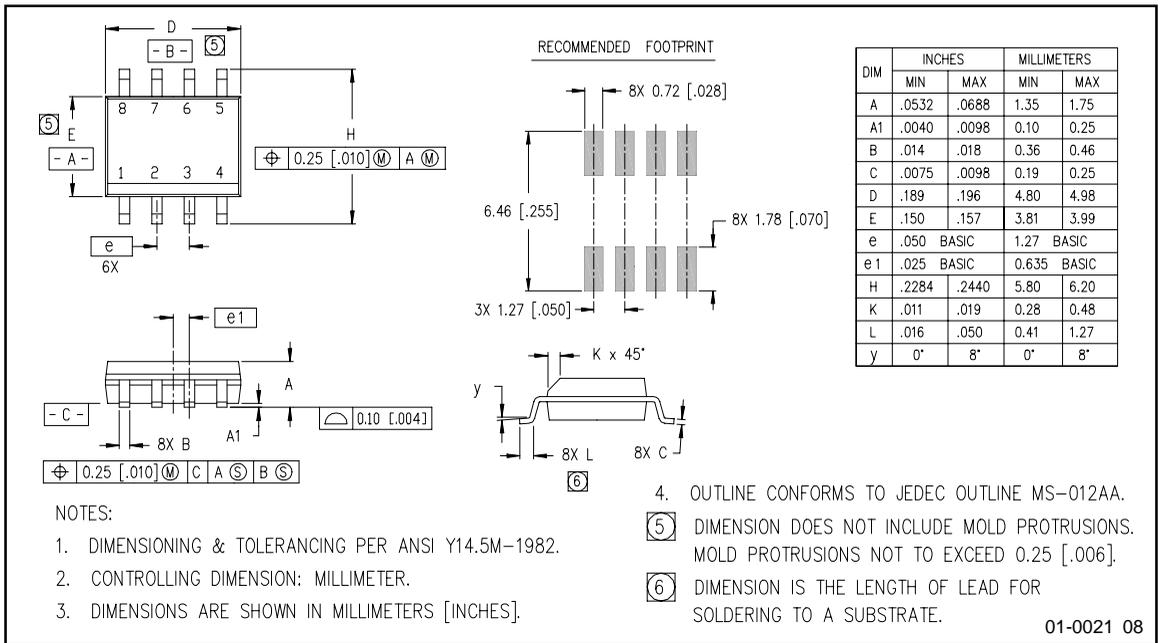
V<sub>CC</sub> = 14V, Resistive Load = 3<sub>Ω</sub>, R<sub>input</sub> = 50<sub>Ω</sub>, 100msec pulse, T<sub>J</sub> = 25°C, (unless otherwise specified).

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
T <sub>on</sub>	Turn-on delay time	—	0.6	—	msec	See figure 2
T <sub>r</sub>	Rise time	—	1.2	—		
T <sub>rf</sub>	Time to 130% final R <sub>ds(on)</sub>	—	8.0	—		
T <sub>off</sub>	Turn-off delay time	—	3	—		See figure 2
T <sub>f</sub>	Fall time	—	1.4	—		
Q <sub>in</sub>	Total gate charge	—	11	—	nC	V <sub>in</sub> = 5V

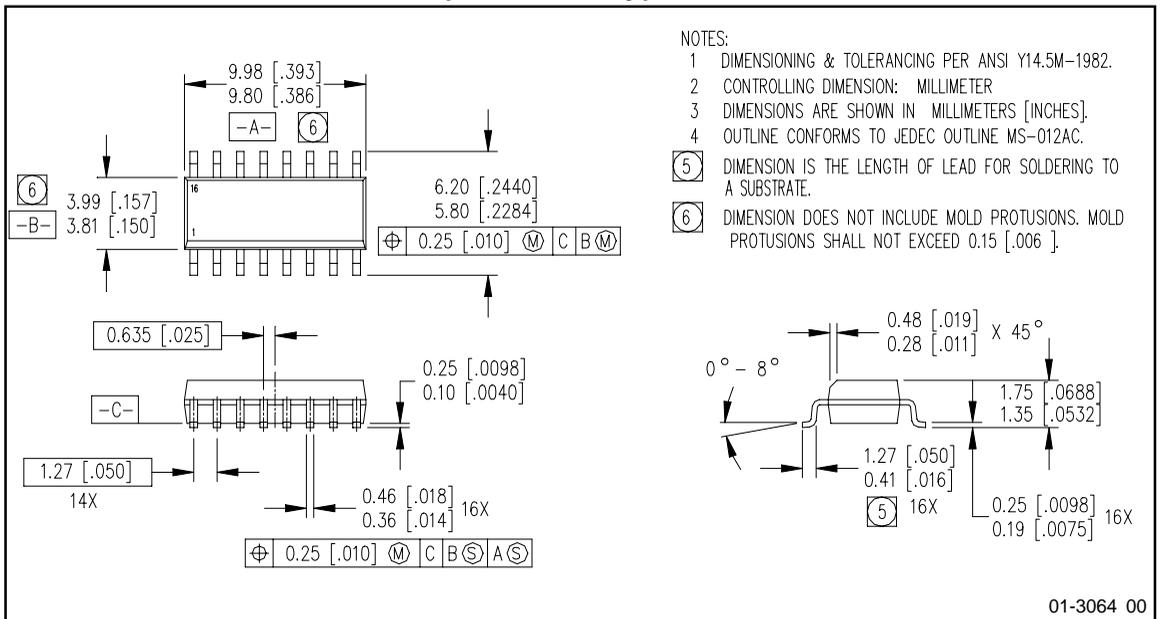
(2) Operations at higher switching frequencies is possible. See Appl. notes.



Case Outline - 8 Lead SOIC



Case Outline - 16 Lead SOIC (narrow body)



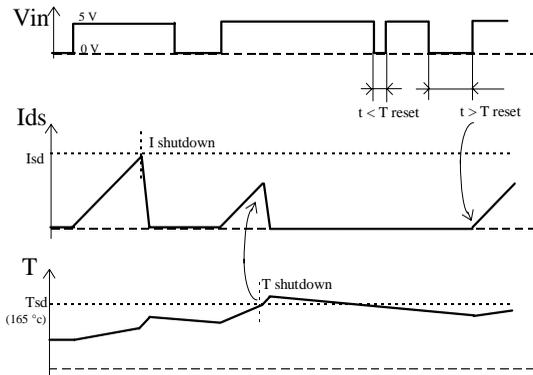


Figure 1 - Timing diagram

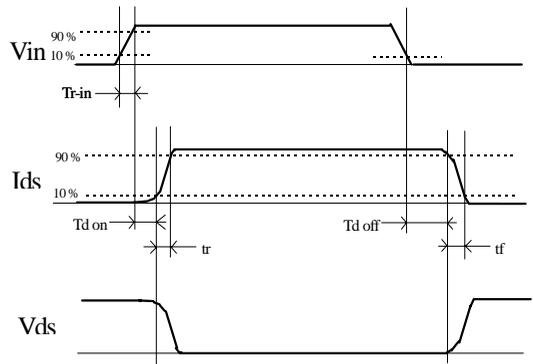


Figure 2 - IN rise time & switching time definitions

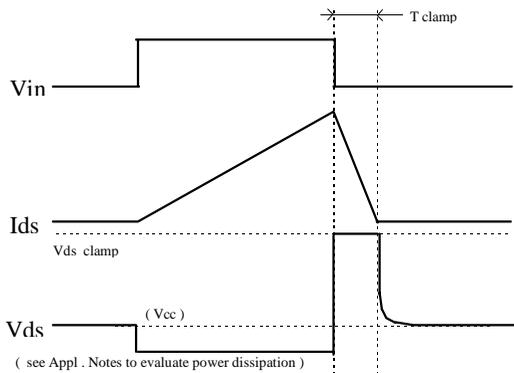


Figure 3 - Active clamp waveforms

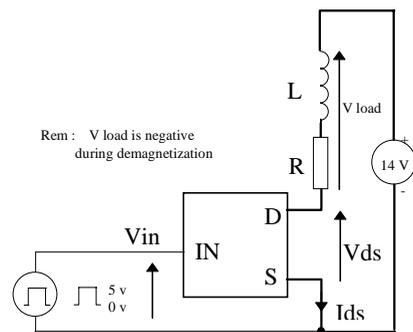


Figure 4 - Active clamp test circuit

All curves are typical values with standard footprints. Operating in the shaded area is not recommended.

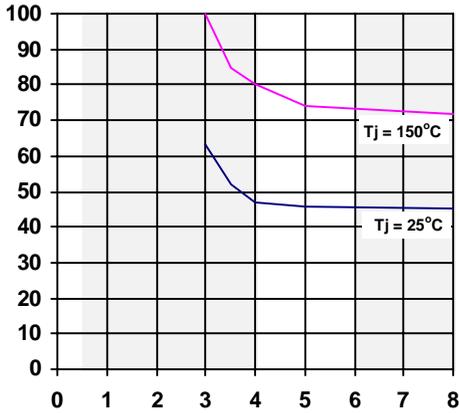


Figure 5 - Rds ON (mW) Vs Input Voltage (V)

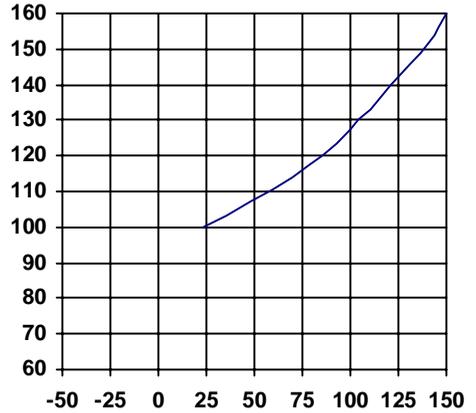


Figure 6 - Normalised Rds ON (%) Vs Tj (°C)

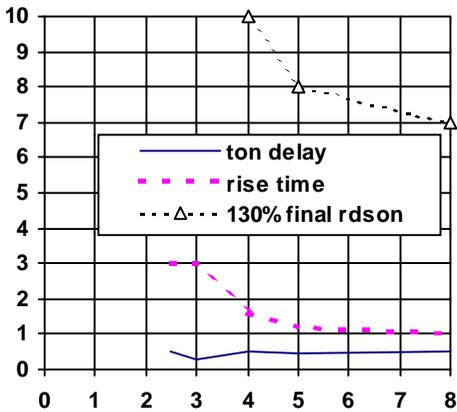


Figure 7 - Turn-ON Delay Time, Rise Time & Time to 130% final Rds(on) Vs Input Voltage (V)

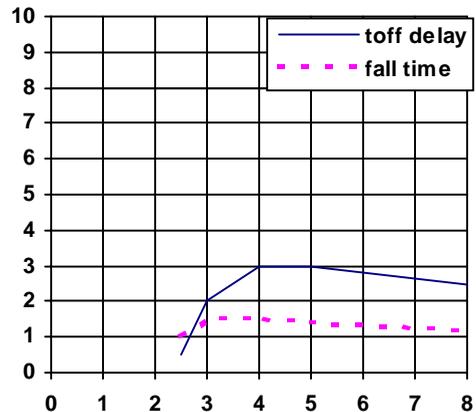


Figure 8 - Turn-OFF Delay Time & Fall Time (us) Vs Input Voltage (V)

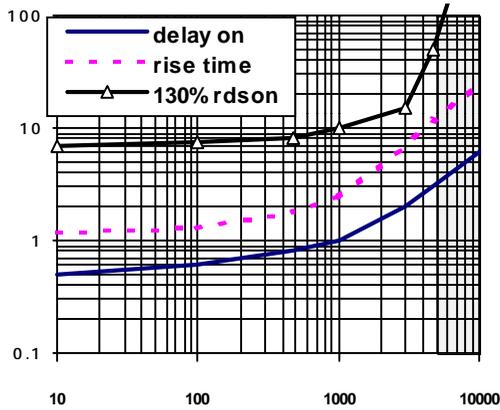


Figure 9 - Turn-ON Delay Time, Rise Time & Time to 130% final Rds(on) Vs IN Resistor ( $\omega$ )

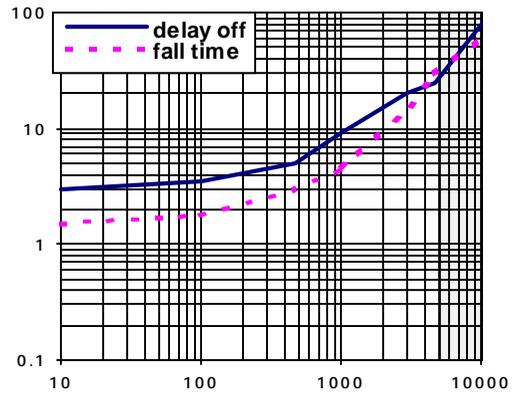


Figure 10 - Turn-OFF Delay Time & Fall Time (us) Vs IN Resistor ( $\omega$ )

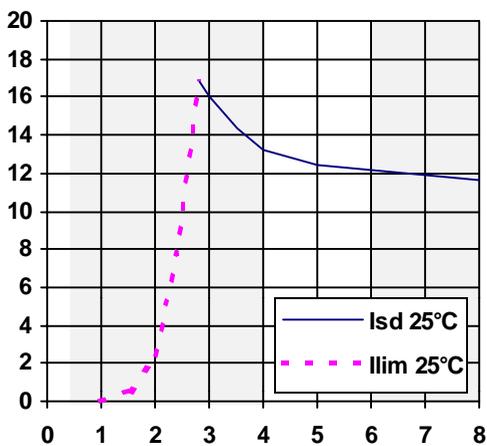


Figure 11 - Current lim. & Ishutdown (A) Vs  $V_{in}$  (V)

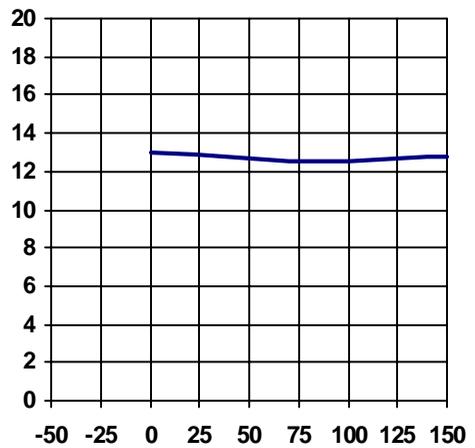


Figure 12 - Over-current (A) Vs Temperature ( $^{\circ}\text{C}$ )

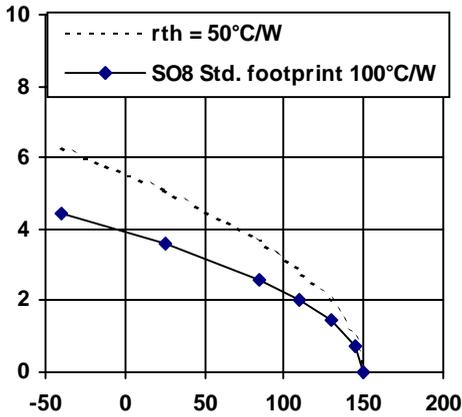


Figure 13a - Max.Cont. Ids (A)  
Vs Amb. Temperature (°C) - IPS031G

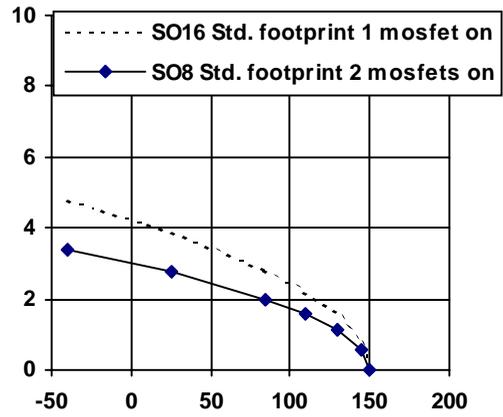


Figure 13b - Max.Cont. Ids (A)  
Vs Amb. Temperature (°C) - IPS032G

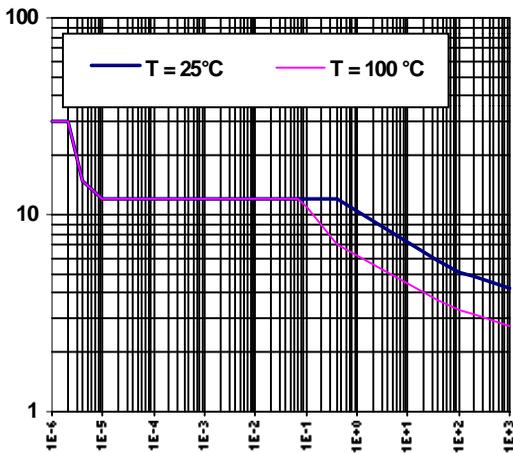


Figure 14 - Ids (A) Vs Protection Resp. Time (s)  
IPS031G/IPS032G

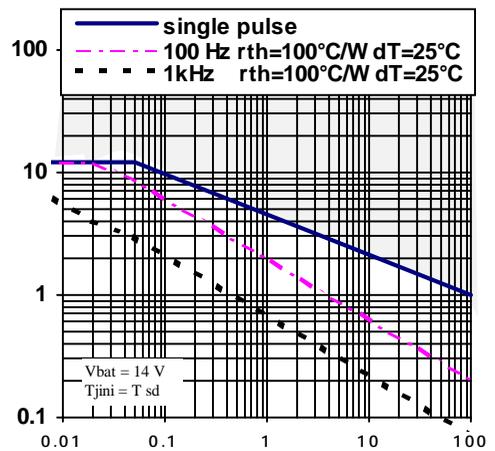


Figure 15 - Iclamp (A) Vs Inductive Load (mH)

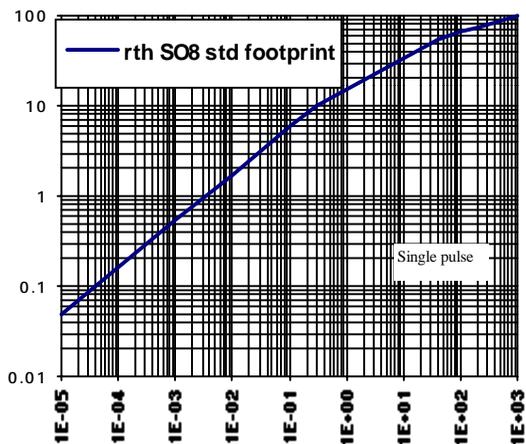


Figure 16a - Transient Thermal Imped. (°C/W)  
 Vs Time (s) - IPS031G

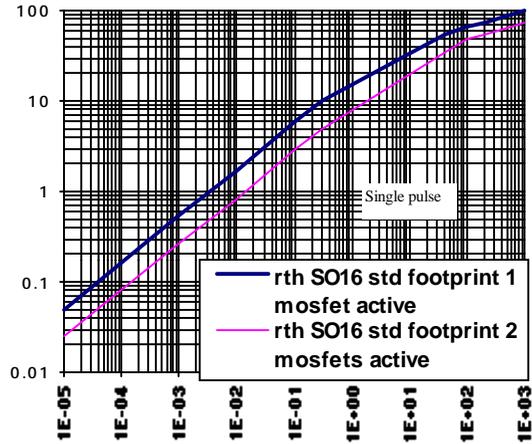


Figure 16b - Transient Thermal Imped. (°C/W)  
 Vs Time (s) - IPS032G